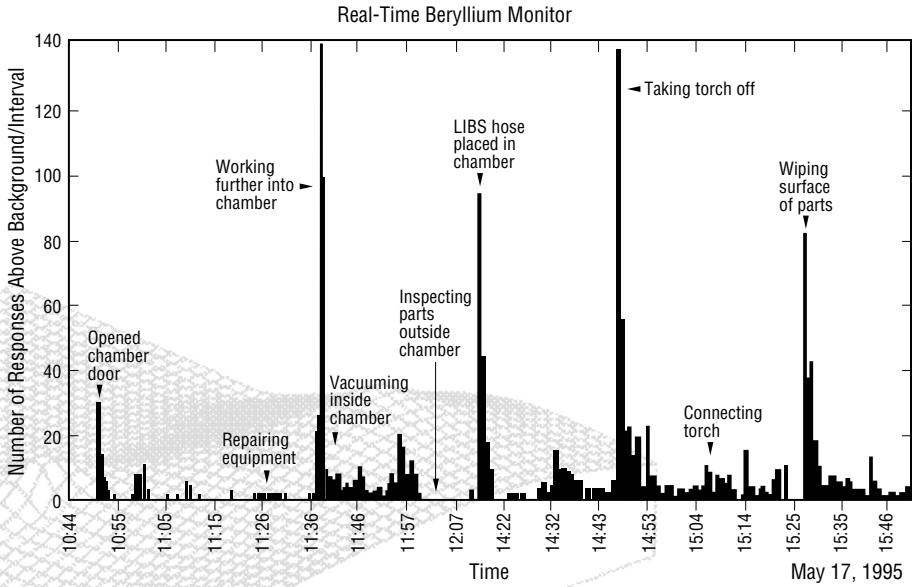
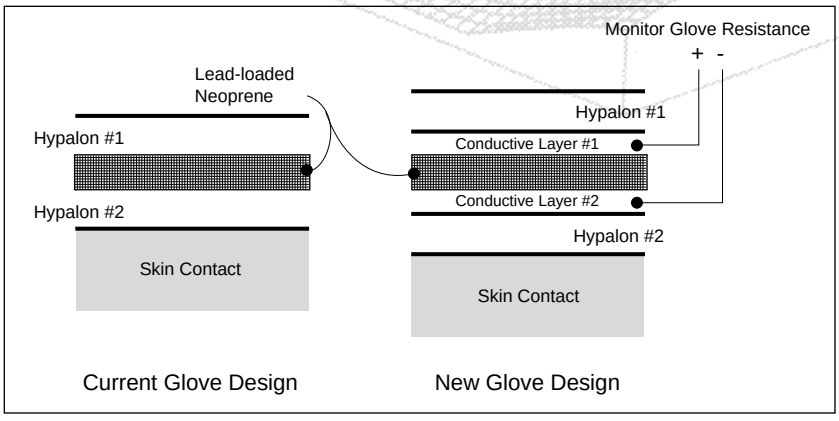
LA-13191-PR
Progress Report

Technology Development, Evaluation, and Application (TDEA) FY 1995 Progress Report

Environment, Safety, and Health (ESH) Division





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Abstract
TDEA is a program developed by ESH Division to answer Laboratory ES&H needs by developing new technologies. In FY95, the division supported five small projects at a cost of $300K two in neutron dosimetry and one each in exposure assessment, engineering controls, and personal protective equipment. This report describes the program, provides a brief summary of each project, and presents an analysis of the program during its first six months.

This is the first report in this series.

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Los Alamos, New Mexico 87545

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INTRODUCTION

The public expects that the Los Alamos National Laboratory (LANL, Laboratory) will conduct its operations in a manner that prevents negative impacts to environment, safety, and health. To achieve this goal within budget, the Department of Energy (DOE) and the Laboratory must develop new technologies and implement innovative approaches that will cost effectively improve ES&H protection.

In FY95, ESH Division initiated the TDEA program by allocating <1% of its annual budget to technologies that would more effectively help ameliorate Laboratory ES&H problems. Because the program and funding was not available to principal investigators until April 1995, this report covers only six months of effort including start-up time.

The priorities of TDEA are that the program must

- benefit Laboratory workers and the public,
- support Laboratory mission objectives,
- respond to needs that derive from the unique expertise of the Laboratory and Laboratory requirements,
- achieve success within three years, and
- transfer technology to other DOE sites.

The program's focus on answering Laboratory needs in regards to solving ES&H problems makes it noncompetitive with the Laboratory's Laboratory Directed Research and Development Program.

During FY95, ESH Division identified ES&H priorities that would benefit from development of new technologies. In FY95, the division supported five small projects (total program cost of $300 thousand)—two in neutron dosimetry and one each in exposure assessment, engineering controls, and personal protective equipment.

The program in its early stage has achieved the following:

- improved methods for estimating worker neutron dose,
- evaluated the effectiveness of exposure assessment using continuous air monitors (CAMs),
- identified procedures to locate CAMs, and
- set up collaborations with industry for the preparation and testing of new protective gloves.

In FY95, fifteen proposals were submitted for funding. ESH Division chartered a steering committee (see list of members in the appendix). Each member of the committee individually reviewed and ranked each proposal against a set of criteria. Committee members met, compared rankings, and discussed the merits of each proposal. The criteria were used as a tool for ranking proposals but were only a starting point for selection of proposals to be funded. Award amounts may have been less than the amount initially requested because of the availability of funds, merit of the proposal, and probability of success.

Success measures for the program are

- publication of funded projects,
- presentations on funded projects,
- cost savings to the Laboratory through efficiencies gained by developing technology,
- new technologies derived from projects, which yield better protection and save dollars,
- ability of a project to attract external funding through Work for Others, DOE, etc.,
- improved protection of the worker, the public, and the environment,
- project contribution toward improved productivity within line organizations, and
- improved status of the Laboratory's ES&H programs.

Current success indicators realized from TDEA are

- matching funds for one program from the Nuclear Materials Technology Division for FY96,
- contribution of in-kind beam-time support to the Neutron Dosimetry effort at the Los Alamos Neutron Scattering Center during FY95, and
- presentations at an international symposium and national meetings.

After two years, Laboratory line organizations will evaluate the benefits of TDEA.

ESH Division's future plans for TDEA include redefining priorities with more input from line organizations, increasing funding commitments to 2–3% of the ESH Division budget by FY2000, and seeking additional outside funding. ESH Division hopes to extend this effort to support Laboratory-wide line organization involvement in developing ES&H technologies.

FY 1995 Project Summaries

Pilot Program for the Risk-Based Surveillance of Lung Cancer in Los Alamos National Laboratory Workers

Principal Investigators: H. Smith (co-principal investigator), L. Wiggs, J. Williams, Occupational Medicine (ESH-2); J. Schinkel, B. Hargis, Industrial Hygiene and Safety (ESH-5); B. Mowrey (co-principal investigator), B. Lehnert, J. Jett, Cell Growth Damage and Repair (LS-1)

FY95 funding level: $66K

This two-part pilot study will

- identify a cohort of workers that are at increased risk for lung cancer based on their occupational exposures at LANL and
- investigate potential biomarkers that will detect lung cancer in sputum collected from the at-risk worker population.

The objective of the first part of the study is to develop a basis for screening sputum for the presence of selected lung cancer biomarkers using an approach based on fluorescence detection.

During FY95, principal investigators merged information from a medical record data base with radiation exposure data to create an analytic file for statistical analysis. The statistical package BMDP was used to generate descriptive analyses. The team developed the medical record database using a roster of approximately 600 current Laboratory employees participating in medical surveillance for potential exposure to one or more potential lung carcinogens. They then abstracted the medical records for a subcohort of 374 of these workers and entered their data into an Oracle database. The Policy and Program Analysis Group (ESH-12) provided external radiation exposure information and ESH-5 matched the roster with industrial hygiene exposure data.

The principal investigators also reviewed literature regarding risk factors for the development of lung cancer to determine which factors were most important in assessing a person's risk of developing lung cancer. A pilot classification scheme for characterizing workers by risk used these factors. Results to date are as follows:

- identified workers potentially exposed to five or less substances,
- attempted to determine the first date of potential exposure, and
- categorized the cohort on the basis of smoking status.

When the team examined the monitoring and exposure status for external ionizing radiation , it determined that 373 of the 374 (99.7%) individuals had been monitored for exposure to external ionizing radiation at Los Alamos.

Optimization of Placement of Workplace Continuous Air Monitoring (CAM) Instrumentation

Principal Investigators: J. C. Rodgers and J. J. Whicker, Health Physics Measurements (ESH-4)

FY95 funding level: $100K

The team working on this project has developed a method for placing CAMs that is based on a combined sensitivity metric. Principal investigators used data derived from polydisperse aerosol release studies conducted in the Laboratory's Plutonium Facility (PF-4 rooms 209 and 420) to develop and test the metric. To date, they have used two weighted parameters for the metric—lag time and maximum concentration—and other facility use factors.

The development of computational fluid dynamics models of room air-mixing is a major component of this project. FY95 accomplishments in this area include the following:

- successfully transferred the GASFLOW2.0 CFD code from a CRAY platform to SUN and SGI work stations;
- built a computer model of PF-4 room 420; and
- performed flow field analyses, which are still under investigation.

The team continues to work on issues related to solution convergence and aerosol modeling.

Additionally, tasks have been undertaken by the team, some of which will be ongoing in FY96.

- The experimental test room in the UTREX high bay has been constructed and plans are as follow:
  - –the room will function as either a full-scale model of a workroom or a scale model;
  - – gloveboxes and fixtures can be readily changed;
  - – consequences for CAM placement optimization will be systematically studied and modeled;
  - – detailed measurement of flow properties will be conducted using thermal anemometry;
  - – test aerosols will be generated and sampled by LPCs, CAMS, and filter air samplers; and
  - – close interaction between modeling and experimental measurement will lead to increasingly accurate predictive capability for CAM placement.
- Preliminary testing of baseline aerosol conditions under various operating conditions and assembly and testing of aerosol generating and sampling equipment will be conducted.

Principal investigators presented the results from applications of the developed method to PF-4 data at the 1995 Health Physics Society meeting (LAUR-95-454). They also presented a poster session on CFD modeling of highly turbulent flow at the Health Physics Society meeting (LAUR-95-0461).

A Polymetric Barrier Monitor to Protect Workers

Principal Investigators: D. Ramsey, T. Stampfer, B. Reinert, Industrial Hygiene and Safety (ESH-5); R. Hermes, Materials Technologies: Polymers and Coatings (MST-7)

FY95 funding level: $50K

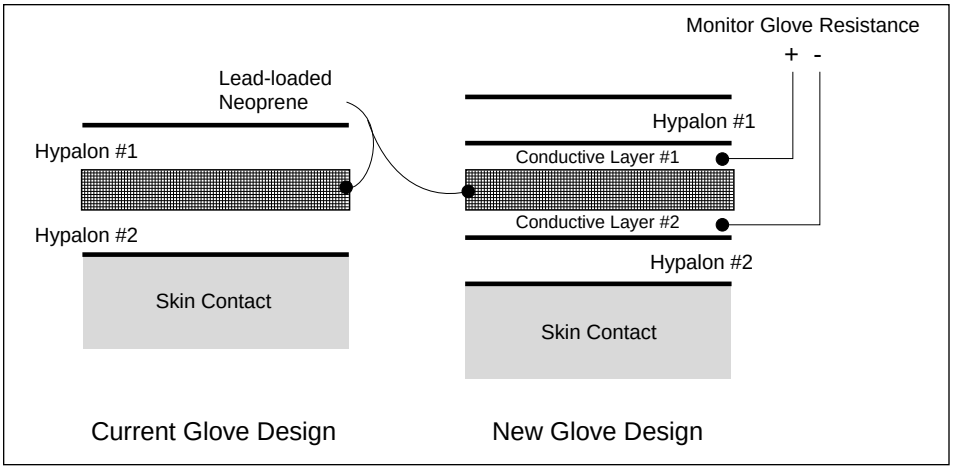
This project provided additional development and evaluation of a new system for the near real-time detection of punctures in protective materials used by radiological workers.

The study was a continuation of work that developed a preliminary system. PIs modified the design found in radiological control glove-box gloves to include two conducting polymer layers between the three nonconducting layers normally found in the gloves. Punctures are detected by the forced contact between the two conductive layers during actual use.

The current work included laboratory scale-testing of several conductive layer materials in a five-layered design, including a currently available glove material that was found to be useful for this purpose.

FY95 research investigated a variety of conductive polymers, some cheap and some outrageously expensive. Films of each of eleven materials were tested for conductivity using a Fluke Model 77 digital multimeter in the resistance mode. The team determined that a commercially available glove material used by North Hand Protection may have enough conductivity to be useful.

FY95 milestones were met, including the making of the mandrel-coated "finger." Because of the choice of materials, any electrode material will be compatible with the new system.



Glove Barrier Technology

Evaluation of a Real-Time Beryllium Detection Instrument and the Implications of its Use

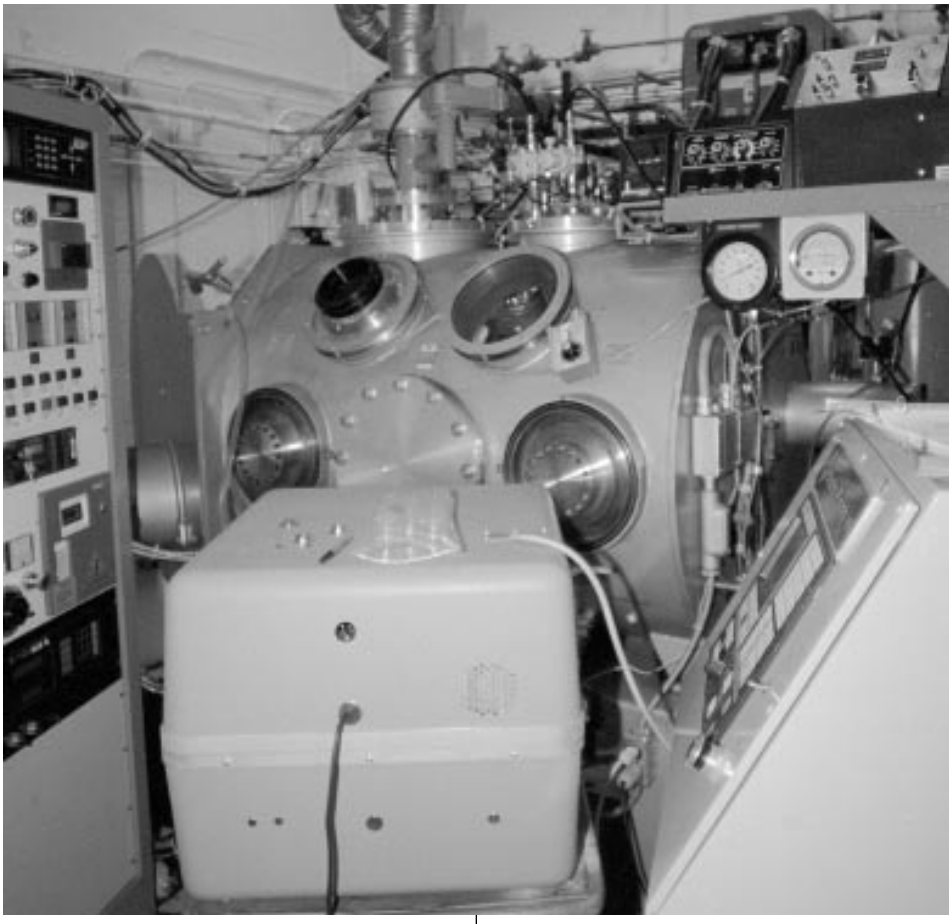
Principal Investigators: G. Langner, K. Creek, and D. Killough, Industrial Hygiene and Safety (ESH-5)

Funding level: $62K

Los Alamos National Laboratory has developed an instantaneous read-out instrument that is based on laser-induced breakdown spectroscopy (LIBS) and measures airborne concentration levels of beryllium. The principal investigators tested the instrument during Beryllium Operation Facility operations, comparing and contrasting data collected by current industrial hygiene monitoring methods and LIBS instantaneous data.

Investigators used a portable LIBS monitor equipped with a focused high-powered Q-switched neodynium:yttrium-aluminum garnet (Nd:YAG) laser. The laser beam induces a dielectric breakdown of air in the sample stream and forms a plasma spark. Beryllium particles in the region of the spark are vaporized and the beryllium is excited. A fiber-optic cable focused on the sample port collects light emitted with excitation decay. The light is directed to the entrance slit of a small spectrograph tuned to the most intense beryllium (II) line of 313.1nm. In this study, a photomultiplier tube detected the beryllium emission and an analog-to-digital processor located inside a computer integrated the signal and digitized the resulting voltage. The resulting signals were stored in the computer's memory. The laser has a repetition rate of 10 hertz with a sample interval of 30 seconds. The laser spark volume was 0.03 cm^3 and the output energy was 100mJ/pulse. The computer controlled all instrument operations.

For most of the sampling events, the LIBS monitor was inside the beryllium-limited access area with the computer located outside in the air lock room. Each sample covered a 30-second interval. The points indicate the steps of the beryllium facility's operation that are associated with peak personnel exposures; the sum



Real-time beryllium monitor

of all the 30-second intervals provides an "exposure profile." The relative peaks and lows of real-time data were correlated with work practices and control measures. Clear evidence was found that the spraying of vacuumed parts with a cleaning agent and the subsequent wiping of them creates airborne beryllium.

The data from a sampling event that occurred when workers were troubleshooting and repairing equipment show that engineering controls do not capture all particles when workers open the chamber. Parts must be vacuumed prior to their manipulation and a vacuum attachment should be used for working inside the chamber. Another sampling event showed that workers were generating airborne beryllium when they moved around in beryllium-contaminated clothing. This study brought about changed work practices—workers change their visibly contaminated clothing.

This study demonstrates that the LIBS instrument detects airborne beryllium in the workplace. The instrument identifies operations of higher exposure potential associated with higher concentration levels. Use of the LIBS monitor demonstrates that some established, accepted work practices produce unexpected exposure situations. Conventional industrial hygiene sampling methods would not have shown the level of detail necessary to determine when exposures occur. Because of the data collected by this real-time instrument, the investigators identified work practices producing emissions that were than easily modified, therefore reducing potential worker exposure to a highly toxic chemical.

The results of this study were presented at the Waste Management '96 Conference held February 1996.

High-Energy Neutron Dosimetry

Principal Investigators: R. T. Devine, Health Physics Measurements (ESH-4), S. Walker Health Physics Operations (ESH-1)

FY95 funding level: $14K

The objective of this two-year study is to determine the response of neutron personnel dosimetry measuring devices: NTA emulsions, etch detectors, bubble dosimeters, electronic dosimeters, Bonner Spheres and rem meters to the fields available at Los Alamos Meson Physics Facility (LAMPF).

The approach is to expose devices for the determination of personnel dose in fields available at LAMPF. The LAMPF staff in P-23 will provide spectra that will be weighted with the NCRP-38 factors quoted in 10CFR835. They will also provide flux information and field uniformity information. ESH-4 and ESH-1 personnel will expose the devices and determine the response.

At the end of the first year, the following conclusions have been reached. The sensitivity and low background of NTA film make this system the best for monitoring personnel. The lower limit of detection is about 0.01 mSv. The practical difficulties in the use of this system, which result from the fading in the dosimeter and the method of reading, are significant impediments to its use and limit the issue period to about one month. The plastic dosimeter material has a lower limit of detection of about 0.4 mSv at energies of the order of 100 MeV. Fade in the plastics is negligible up to about a year and methods of automation for reading both types of plastic are available. The primary difference between the chemical etch and electrochemical etch systems is that the batch size in the former can be up to 240 while the latter is limited to about 24. The chemical etch system would be appropriate for applications where the badge issue period could be three-to-six months, and track-etch dosimeters could provide a practical alternative to NTA film up to 100 MeV.

The objective of this project is a new and better calibrated system for measuring high-energy neutrons at LAMPF: a personnel dosimeter using track-etch technology and a real-time monitor using either bubble dosimetry or electronic dosimeters.

The results of this project will be prepared for publication in a peer-reviewed journal.

CONCLUSION

Because only six months of FY95 were available for investigations and studies, principal investigators had difficulty in drawing conclusions from their limited studies; therefore, conclusions from each of the studies may appear to be lacking in content. In spite of this, the TDEA Steering Committee is satisfied with the results of the program's pilot year. The program has had a good start.

High priorities for the steering committee and ESH Division are

- to keep TDEA funding available for addressing ES&H concerns,
- to obtain matching support from other divisions that benefit from these studies, and
- to identify opportunities for external funding that will extend these studies.

Also, the committee will focus on drawing each continuing and new project to closure.

APPENDIX

Request for Proposals

LANL-ES&H Division Technology Development, Evaluation & Application Studies

ES&H Division has initiated a program to fund LANL-ES&H related technology development evaluation and application projects. Such efforts must be closely related to LANL ES&H requirements & needs. This is also an excellent opportunity for LANL technical staff to become involved with the LANL ES&H program by partnering with ES&H Division staff.

For FY 96: The program will focus on (in alphabetical order):

Dosimetry	Monitoring
Instrumentation	Neutron measurements

Call for Proposals to all potentially interested Principal Investigators.

Attachment #1 lists all Committee Members, who will be available to answer any questions which may arise.

Attachment #2 is a list of LANL ES&H Division Program Priorities for FY 1996 based on input from ESH Groups, and review by the Committee. This is intended as a guide to proposal preparers. If necessary, further clarification can be obtained from any member of the Steering Committee.

Attachment #3 is a relative prioritization criteria list to be used by the Committee in reviewing proposals. These criteria should help Principal Investigators better focus their effort. Because of the funding source, it is mandatory that the proposed work be applicable to LANL-ES&H problems (near term and longer term).

Attachment #4 is an example of a standard format. The Principal Investigator should make sure that the proposal addresses the items noted and is clearly applicable to LANL ES&H problems. The overall rating of the Proposal will be based on the criteria noted in Attachment #3 and the technical/scientific quality of the proposed project.

Attachment #5 is a copy of the Committee Charter and is provided as additional information regarding the planned efforts of this Committee.

Ten copies of each proposal should be submitted no later than October 2, 1995 to Larry Andrews, ESH-DO, MS K491.

This deadline will permit the Committee to aim at having its funding recommendations completed by the end of October.

During FY 1996, ~$400K will be funded through the efforts of this Committee. Any final funding decisions will be controlled by funding levels for ESH-Division. While funding is for a single year, each proposal should indicate funding for the duration of the project, which may be multi-year. We expect this to be a continuing program.

Proposals funded by this program in FY 1995 must be resubmitted to request continued funding. The **new**

proposal must indicate the progress in FY 1995 and the purpose and justification for continuance.

Such projects can also provide an opportunity to develop techniques and information that may be used as a foundation for studies to be submitted for DOE or reimbursable funding.

COMMITTEE MEMBERS—January 2, 1995

Name	Affiliation	Phone	Mail Stop	Fax
Larry Andrews	ESH-DO	7-3961	K491	5-3811
Tom Buhl	ESH-4	5-8176	G761	5-6071
Harry Ettinger	ESH-DO	7-4218	K491	5-3811
Bruce Erdal	EM/TD	7-5338	J591	5-8118
Wayne Hansen	EES-15	7-3331	J495	5-3866
Larry Hoffman	ESH-10	505-699-1553	G732	5-4477
Marvin Tillery	ESH-5	5-4427	K494	7-1935

Priority Technical Areas of Interest for FY 1995

The priority technical areas were determined from information submitted by ESH Groups for the FY95 funding year. Enough interest in neutron measurements and dosimetry was displayed in the FY 1995 submissions that the steering committee added neutron investigations to the list. These areas identified are broad categories that encompasses the subjects and projects to be submitted. These are:

1. Dosimetry
2. Instrumentation
3. Monitoring
4. Neutron measurements

Monitoring, for example, may include vital sign monitoring in stressful work situations, methods or techniques for monitoring individuals or equipment for contamination and environmental monitoring. The instrumentation area may include development or improvement of instruments and instrument systems such as personnel monitoring instruments, workplace monitoring instruments or instrumentation designed for environmental measurements. Dosimetry is also a very broad category. It may include radiation biology, new internal dosimetry methods and procedures, and external dosimetry methods. Dosimetry also includes epidemiological studies of LANL workers. Neutron measurements should be associated with dosimetry measurements at some point.

Relative Prioritization and Weighting Factors
Criteria for Priority Listing
July 1995

A. **<u>HIGH</u> (10x)**

- Applicability to specific LANL-ES&H problems

  Priority of need and potential to satisfy need - Examples would be ideas that may significantly reduce risk to workers and/or provide significant long term cost savings. Cost savings must be specified using the latest available information.

  Operational aspects are given more emphasis than solely compliance aspects Development of a system to reduce exposure to carcinogens would be given priority over a system designed to simply demonstrate compliance.

- Cost and/or resource saving for ES&H operations/applications

  Improved efficiency of ES&H activities - Specify estimates of cost and/or resource savings. As an example, automating a system that normally would require the extensive use of manpower, but is a repetitive set of tasks that may only need to be programmed once. Specify those savings in the long term future as well as the short term. Return on investment. The effort may cost $50K up front, but would save 5 times that value every year in personnel costs (show calculations).

- Probability of success

  Both immediate program goals and application to ES&H needs and operations - Projects must be not only applicable but will receive higher scores for their practicality and ease of implementation for solving ES&H problems. The approach should be delineated.

B. **<u>INTERMEDIATE</u> (5x)**

- Relative magnitude of costs

  <u>Considering both total budget and proposal budget</u> - It is difficult to fund a project for more than $100K in any given year.

  <u>Considering leveraging of funding, both immediate and long term</u> - Preference will be given to projects with shorter completion times, with a 1 to 2 year preference. Longer projects will be considered if they can be justified in terms of long term cost savings. Teaming with a line organization is desirable, and resource support from the line organization is a strong indication of the importance to operating programs.

- Temporal considerations

Time to meet objectives or application of technology. - The urgency associated with the effort.

- Interactions with others

  Collaboration with others - Preferences will be given to partnering with other laboratory divisions, government agencies, universities, etc., if appropriate.

C. <u>LOWER</u> (3x)

- Innovative approaches to solve ES&H problems
- ESH Division is the only likely source of support
- Maturity of technology development

FORMAT FOR PROPOSALS
July 1995

Only proposals that are submitted with the following format will be evaluated.

Title Page (One Page)

Title
Name of Principal Investigator(s), co-investigators, and Group(s)
Requested Budget (by year)
Date of Submission
New or continuing propos**al**

Written Portion of Proposal (Five Pages Maximum) Submit proposals with numbering that corresponds with the below criteria.

1. A clear succinct description of problem to be addressed.

2. Benefit

   A description of the benefit to the LANL ES&H Programs as a result of the completion of the proposed project . This must include either benefits related to the environment, worker/public health and safety, or improved operations. An estimate in $ (dollars) or resources to be gained through direct cost savings and/or improved efficiencies and/or improved health and safety is desirable. Some indication of the near term and/or long term benefits to LANL must be provided to be responsive to the "High Criteria" noted in Attachment #3.

3. Background and Objective(s)

   A discussion of the relevant background of the proposed project which would be sufficient for the reviewers understanding of the proposed work. The objective(s) of the proposed project should be clearly stated at the end of this section.

4. Work plan

   The workplan should include a discussion of the approach, budget, schedule, and applicability to the regulatory agencies.

5. Deliverable(s)

   A concise discussion of what the proposed project will deliver, such as an improved methodology or a method, and what is necessary to implement the method and when it will be tested/reviewed enough for implementation.

6. Reports

Monthly reports must be submitted for review to the Committee, who will discuss with the PI the level of detail for such reports, and will identify any problems they see regarding progress or schedules.

7. Schedule (One Page)

The schedule should be in a Gantt Chart type of format showing activities, duration's, and milestones (including deliverables).

8. Budget (One Page)

The budget should reflect the major elements of the project, which will correspond to the activities on the schedule. Separately indicate Operating, Capital, FTE's. At this time it is not clear that any capital equipment funds will be available.

9. ES&H Evaluation

The proposal should briefly indicate that potential ES&H concerns associated with performing the study have been evaluated, and note what action (if any) is required to assure that the proposed study will be conducted in a manner to protect employees, contractors, the public, and the environment from the harmful effects of anticipated hazards.

Charter
of the
Technology Development Evaluation and Application Studies Steering Committee
for
ES&H Division
July 1995

Background

The Los Alamos National Laboratory (LANL) ES&H Division has responsibility for protecting the health of LANL workers and the public. This represents a major continuing effort which results in expenditures of over $60 Million dollars/year. Initial emphasis of this program is on improved health and safety and/or improvements in efficiency and/or improved resource utilization. Because of the magnitude and associated cost of the total ES&H effort, the LANL ES&H Division initiated a program to fund applied studies to address special needs/problems. To satisfy LANL requirements all projects must be directly supportive of the LANL ES&H programs.

The potential benefit from a highly focused program of this type, is to address ES&H problems in a cost effective manner.

Steering Committee - Scope of Activities

The Steering Committee for LANL ES&H Division Technology Development, Evaluation and Application Studies will be responsible for encouraging development of proposals from ES&H Division staff, which are aimed at helping to solve some of the LANL ES&H program requirements. This Committee will be chaired by a representative of ESH DO. The Steering Committee will be responsible for:

1) Obtaining information from the LANL ES&H programs to identify priority interests;

2) Synthesizing this information into a convenient format and transmitting this information (soliciting proposals) to potential principal investigators.

3) Identifying a schedule and standard format for submissions of proposals for possible funding by the LANL-ER program;

4) Developing criteria that will be used to: a)review each proposal's technical merit, and b)estimate the time scale for application to solving ES&H problems at LANL.

5) Reviewing all submitted proposals for a)relevance to LANL ES&H programs; b)technical quality; c)probability for success; d)time scale for application at LANL; and e)appropriateness of the budget.

6) Recommending funding

7) Developing a mechanism for informing the principal investigator for each proposal of the results

of the Steering Committee's evaluation of their proposal.

8) Documenting the complete review and approval process.

Attachment A represents the criteria which will be used by the Steering Committee when evaluating proposals. This listing may be expanded by the Committee on the basis of additional information developed and/or policies adopted by LANL, DOE, OSHA, EPA, NMED, etc. Attachment B is the format to be used for all proposals.

Program Monitoring and Reports

As distinct from many technology efforts, this program must (because of the funding source) be focused on LANL ES&H program requirements and relatively short term solutions to specific LANL problems. Monthly reports must be submitted for review to the Committee, who will discuss with the PI an appropriate format and level of detail for such reports, and will identify any problems they see regarding progress or schedules. It is the responsibility of the Committee to alert PI's to situations which may result in funding changes. Funding may be discontinued if progress is not compatible with LANL ES&H program requirements, priorities or funding limitations.

Funding Outlook

The magnitude and complexity of the tasks facing the LANL ES&H program, and the initial support from ESH-DO indicates that funding should be available in future years. But this is contingent on budget constraints.

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